Mapping the Gold Butte Block with Visible through Thermal Infrared Spectroscopy

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Abstract

In 1998 and 1999 Airborne Visible Infrared Imaging Spectrometer (AVIRIS) and MODIS/ASTER Airborne Simulator (MASTER) data were acquired over the Gold Butte Block, NV in order to evaluate the use of visible to thermal infrared data for geological mapping. The Gold Butte block was selected since it contains a diverse range of igneous, metamorphic and sedimentary rocks ranging in age from early Proterozoic to Tertiary.

Both datasets were calibrated and atmospherically corrected and the reflectance and emissivity information extracted. Analysis of the MASTER reflectance data focused on the 2.08 to 2.45 um region using spectral-fitting algorithms. Distinguishing rock and soil exposures containing clay minerals versus carbonate minerals was straightforward using either dataset. A Comparison of the matched-filter analysis results from AVIRIS and MASTER indicate that while some calcitic exposures can be separated from dolomitic exposures in the MASTER data, the separation with AVIRIS is more clearly defined. Mapping Mg-OH minerals using MASTER data proved difficult because of the similarity of the Mg-OH absorption feature and the carbonate feature in the 2.35 um region.

Using the emissivity data it was possible to map the known rock units as well as several additional units. In particular, the emissivity data permitted further subdivision of the Proterozoic rocks and the identification of a large quartz syenite. The quartz syenite body was subsequently found to coincide with a strong aeromagnetic low anomaly. The emissivity data were then used to produce a weight percent silica map based on the known shift in the emissivitiy minimum of igneous rocks from felsic to mafic compositions. The map was field checked and agreed with field samples to a few percent.

The results indicate that by using the combined wavelength region it is possible to map a wide range of minerals and rocks as well as estimate weight percent silica from igneous rocks. The maps from the study are currently being incorporated into the updated 1:100,000 Lake Mead sheet as well as the 1:24,000 Hiller Mtns sheet.

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